ARTICLE / INVESTIGACIÓN

Effect of D-Aspartic acid on the level of some sex hormones and the biochemical parameters of the blood of Shami Bucks

Ali Shehab Ahmad[1]*, Safaa Sabbar Atiyah[2]

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[1] Department of Animal Production, College of Agriculture, University of Diyala, Iraq.
[2] Department of Animal Production, Technical Institute of Kufa, Al-Furat Al-Awsat Technical University, Iraq.
Corresponding author: dr.alishehab@gmail.com

Abstract: This study was conducted at the Animal Production Department/ College of the Agriculture/ University of Diyala from 15/9/2021 to 15/10/2021 to investigate the effect of injecting D-aspartic amino acid in Shami Bucks on some blood biochemical and hormonal characteristics. Twelve's Shami Bucks aged between 1.5-2 years, and body weight ranged between 35-40 kg. The animals were divided into four groups (treatments) with three replicates among each group as follows, T_1 (control group) was injected with normal saline only, T_2, T_3 and T_4 groups were injected i.m. with D-aspartic acid as follows, 125 mg, 250 mg and 375 mg for T_2, T_3 and T_4 groups respectively, every 48 hours in the afternoon. Blood samples were collected from the jugular vein, and serum was taken and stored at -20 ° C until analyzed. The results of the present study also indicated significant differences (P<0.05) of FSH (1.37±2.59, 1.45±0.89, 1.87±1.76 and 0.77±0.45) and LH (1.96±1.56, 2.19 ± 0.22, 2.22±1.44 and 1.11±1.30) respectively for the T_2, T_3 and T_4 treatments as compared with the T_1 (control group). The results showed a significant increase (P<0.05) of total protein (6.23±0.02, 6.26±0.39, 6.46±1.23 and 4.35±0.12), albumin (4.36±1.24, 4.56±1.00, 4.75±1.34 and 3.34±0.11), globulin (1.87±1.33, 1.70±0.11, 1.71±0.01 and 1.01±1.22) and blood urea (6.45±0.23, 6.43±1.39, 6.56±1.56 and 5.22±1.25) respectively for the T_2, T_3 and T_4 treatments as compared with the T_1 (control group). While no significant differences between all experimental treatments in the concentrations of thyroid hormones (T_4, T_3), cholesterol and triglycerides. It can be concluded from the present study that injection of D-aspartic acid had a significant effect on some biochemical blood traits and the level of pituitary sex hormones.

Key words: D-Aspartic acid, Shami Bucks, biochemical parameters, sex hormones.

Introduction

Goats are considered one of the critical economic animals in Iraq, as they are raised for meat, milk, skin and hair, but they live outside pastoralism and agriculture and feed on waste and jungles. Their fertility and productivity are low, so they need to be cared for and their fertility improved[1]. The Shami goat originated in the Sham[2] and was introduced to Cyprus from Syria more than 70 years ago to improve the performance of their goats. Thus, it was called the Cypriot goat. This type of goat was introduced to Iraq (Ruminant Research Station/ General Authority for Agricultural Research/ Ministry of Agriculture) in the name of the Cypriot Shami goats after they were imported from Cyprus through the Ministry of Agriculture in 2006[3]. Several studies have indicated that environmental factors significantly affect the reproductive efficiency of farm animals, such as increasing the daily light duration and high temperatures[4-5]. The measurement of hematological and biochemical parameters is essential in evaluating animal activity. It indicates animal health, reflected in the production characteristics, as the blood and biochemical parameters are affected by breed, age, physiological condition, season, nutrition, etc. The animal body's physiological regulation works well, which is reflected in its ability to adapt to circumstances and prevailing environmental conditions[6-8]. (9) indicated that amino acids such as arginine and aspartic affect the circulatory system by increasing the heart rate without affecting the number of heartbeats and increasing blood flow to the blood vessels, leading to increased blood circulation. Because there is no study in Iraq to our knowledge showing the effect of injecting aspartic acid on some biochemical parameters of Shami Bucks. This study was conducted to find out the impact of injecting the amino acid L-aspartic by measuring the following characteristics, Total protein, Albumin, Globulin, blood urea, Cholesterol, Triglycerides, Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), T_3 (Tri-iodothyronine) and T_4 (Thyroxine).

Materials and methods

This study was conducted at the Animal Production Department/ College of the Agriculture/University of Diyala from 15/9/2021 to 15/10/2021. In the present experiment, twelve Shami Bucks of 1.5-2 years of age and 35-40 kg weight, placed inside semi-open pens in individual cages, were used. The animals were fed with the 1 kg concentrate feed, in addition to giving them hay and green fodder, according to the animal's need (in an open manner) with the availability of drinking water throughout the experiment. The animals were divided into four treated groups with three replicates, T_1 (control group) was injected with normal saline i.m., T_2, T_3 and T_4 were injected with aspartic acid with a concentration

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of 125 mg, 250 mg and 375 mg i.m. respectively every 48 hours in the afternoon. At the end of the experiment, blood samples were collected from the jugular vein using sterile 8ml syringes with a test tube free of anticoagulant, centrifuged at a speed of 3000 rpm for 15 minutes. Serum was withdrawn using a special pipette, numbered and kept in the freezer at -20 °C until all the analyzes of the biochemical components were completed.

Total protein

The measurement depends on the occurrence of a color change due to the interaction of copper in a base solution of the measuring kit (prepared by the German Human company) with the peptide bonds of the protein that is found in the blood serum. The solution is mixed and left at room temperature for 10 minutes; a spectrophotometer extracts it at a wavelength of (520) nm. The following equation is applied to obtain the total protein level[10].

Blood urea

The hydrolysis of urea to ammonium ions and carbon dioxide is the basis for measuring urea in the blood, which was approved by the Human German company manufacture of urea measurement kits. Ammonium ions with chlorine and salicylate produce a blue-green complex. This complex and its concentration are measured by a spectrophotometer on A wavelength (600), which indicates the amount of urea in the blood.

Cholesterol

The level of cholesterol was measured in the blood serum using a spectrophotometer with a wavelength of (500) nm using ready solutions (Kit)[11].

Triglycerides

The triglyceride concentration was estimated using a measuring kit supplied by the Human German company, based on the method of (12), and by a spectrophotometer at a wavelength of (500) nm.

Hormonal assays

The levels of T_3, T_4, FSH, and LH hormones were measured using an Enzyme-linked immunosorbent assay (ELISA) and a kit to measure each hormone supplied by Novormon company.

Statistical Analysis

The experiment was carried out using a completely random design (CRD), and data were analyzed using the statistical program SPSS (SPSS, 2011); the averages of the coefficients for each treatment were compared using Duncan's polynomial test[13] to determine the significance of differences between the means. According to the following mathematical model: Yij = + ti+ eij.

Results and discussion

The results of the present study indicated a significant ($P<0.05$) effect of FSH and LH hormones for T_2 (125 mg), T_3 (250 mg) and T_4 (375 mg) compared to T_1 (control group), which were 1.37±2.59, 1.45±0.89, 1.87±1.76 and 0.77±0.45 for FSH and 1. 96±1.56, 2.19±0.22, 2.22±1.44 and 1.11±1.30 for LH respectively (Table 1). There were no significant differences between all treatments of the experiment and the control group in thyroid hormone concentrations (T_4, T_3) and the control group (Table 1). D'Aniello *et al.*[14] indicated that the level of aspartic acid was elevated in the hypothalamus, pituitary, and blood serum, which reached its highest level after one hour of injection. When comparing them, the highest concentration was found in the hypothalamic glands for the presence of enzymes that convert L-Asp to D-Asp in the gland tissue. These results were also confirmed by Di Fiore *et al.*[15] of the increase in the activity of Neuro-steroidogenic enzymes in the brains of mice injected with aspartic acid.

Sheffield *et al.*[16] found a decrease in the concentration of aspartic acid in sheep's blood plasma and body tissues fed a low concentration of aspartic acid. Still, if fed a diet rich in aspartic acid, the concentration will increase in both body tissues, the brain and endocrine glands. Boni *et al.*[17] showed a high percentage of aspartic acid in the tissues of both the pineal gland and the pituitary gland. Still, the pituitary gland was the most efficient in storing aspartic acid in sheep. It recorded that the concentration of aspartic acid tripled more than the average concentration in the pituitary gland, ovary, brain and blood serum after 12 hours of aspartic acid treatment. There are more than 700 amino acids, but only 20, including aspartic acid, are the building units of proteins in cells[18].

The results showed a significant increase ($P<0.05$) of total protein, albumin, globulin and blood urea for the T_2 (125 mg), T_3 (250 mg) and T_4 (375 mg) treatments compared with the T_1 (control group) (table 2). While no significant differences among the treatments group (T_2, T_3 and T_4). The results also showed no significant differences among all experiment treatments and control groups in the concentrations of cholesterol and triglycerides (Table 2).

Amino acids are of great physiological importance, serving as building units for proteins and substrates to synthesize low-molecular-weight substances. Depending on growth or nitrogen balance, amino acids have traditionally been classified as nutritionally essential or non-essential for animals[19]. Abdelhamed *et al.*[20] mentioned that the concentration of aspartate was the lowest in the local goat breed, while it was the highest in the hybrid goat breed, and this may be due to the breed effect on amino acid production.

Conclusions

The present study showed that injection of D-aspartic acid significantly affected some sex hormones and the biochemical parameters of the blood of local Shami Bucks.

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Conflicts of Interest

There is no conflict.

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Hormones concentration	Treatments			
	T_1 (control)	T_2 (125 mg)	T_3 (250 mg)	T_4 (375 mg)
FSH (ng/ml)	0.77±0.45 b	1.37±2.59 a	1.45±0.89 a	1.87±1.76 a
LH (ng/ml)	1.11±1.30 b	1.96±1.56 a	2.19±0.22 a	2.22±1.44 a
Thyroxin (T_4) (ng/ml)	61.38±1.23 a	61.59±1.2 a	61.55±0.55 a	63.66±0.94 a
Triiodothyronine (T_3) (ng/ml)	2.08±1.16 a	2.47±0.44 a	2.49±1.66 a	2.43±1.70[1] a

[1]Means with different letters within one row indicate significant differences ($p < 0.05$).

Table 1. Effect of aspartic acid injection on thyroid and some pituitary hormones of Shami Bucks (mean ± standard error).

Blood Parameters	Treatments			
	T_1 (control)	T_2 (125 mg)	T_3 (250 mg)	T_4 (375 mg)
Total protein g/dl	4.35±0.12 b	6.23±0.02 a	6.26±0.39 a	6.46±1.23 a
Albumin g/dl	3.34±0.11 b	4.36±1.24 a	4.56±1.00 a	4.75±1.34 a
Globulin g/dl	1.01±1.22 b	1.87±1.33 a	1.70±0.11 a	1.71±0.01 a
Blood urea mg/dl	5.22±1.25 b	6.45±0.23 a	6.43±1.39 a	6.56±1.56 a
Cholesterol mg/dl	19.99±2.22 a	21.11±1.00 a	20.48±1.33 a	21.44±0.76 a
Triglyceride mg/dl	89.88±0.76 a	91.32±2.15 a	90.79±1.00 a	90.76±1.44[1] a

Table 2. Effect of aspartic acid injection on some blood biochemical traits of Shami Bucks (mean ± standard error).

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